From: Barbara Ritchie <BARBARA.RITCHIE@fmc.com>
Sent: Thursday, June 12, 2014 3:03 PM
To: Rochlin, Kevin
Cc: Williams, Jonathan; Douglas.Tanner; Greutert, Ed [USA]; Kelly Wright; Scott Miller; Stifelman, Marc; susanh@ida.net; Zavala, Bernie; Rob Hartman; Marc Bowman; Chad Tomlinson; Marguerite Carpenter; Michael Steiner; David Heineck
Subject: RE: Review of FMC Comment Responses on the Data Gaps Report
Attachments: 2014-06-12 FMC Supplemental Response to EPA Review of RTC on the Data Ga....pdf

Please find attached a supplemental response to comments on the revised Data Gap Report (DGR).

As you recall, on 2/20/14 you provided comments on the DGR FMC submitted for your review on 1/8/14. On 3/3/14 you approved my request for an extension to respond to those comments until 3/14/14, when FMC provided responses to those comments, along with an electronic copy of a revised version of the DGR with revisions highlighted reflecting changes to address the comments.

On 5/31/14, your provided a letter, accepting most FMC responses, but requesting additional clarification in a few instances and providing some additional comments. You had used yellow highlight to call out those comments where FMC's initial response was not fully acceptable. We have used the same convention in the attached where we have added Supplemental Responses to address your requests for clarification. Similarly, our responses to the new comments are highlighted in yellow.

Upon your approval of these supplemented responses, which include the additional or revised text proposed to be incorporated into the DGR, we will make the conforming changes and produce final hard copies as provided in the UAO.

From: Rochlin, Kevin [mailto:rochlin.kevin@epa.gov]
Sent: Saturday, May 31, 2014 10:06 PM
To: Barbara Ritchie
Cc: Williams, Jonathan; Rochlin, Kevin; Douglas.Tanner; Greutert, Ed [USA]; Kelly Wright; Scott Miller; Stifelman, Marc; susanh@ida.net; Zavala, Bernie
Subject: Review of FMC Comment Responses on the Data Gaps Report

See attached.

Kevin Rochlin

FMC Supplemental Response to EPA's Review of Responses
June 12, 2014

TECHNICAL REVIEW OF THE FMC RESPONSES TO EPA COMMENTS ON THE REMEDIAL DESIGN DATA GAP REPORT FOR THE FMC OU FMC IDAHO LLC, POCATELLO, IDAHO (Dated May 29, 2014; Received May 31, 2014)

I. GENERAL COMMENT

1. Original EPA Comment: Field activities and results of the investigation were detailed in the Data Gap Report. However, little discussion was provided to indicate how the new soil data will affect ET cover and gamma cap designs (i.e., acceptability of the borrow soil for its intended purpose). It is expected that such details will be provided in the draft design documents for this project and will be reviewed at that time.

   FMC Response: The purpose of the Data Gap Report was to summarize the field investigation and results of laboratory testing. The data presented in the Data Gap Report is currently being incorporated into the design of the ET covers. Given that the predominant soil type encountered was silt loess, which exhibits both high moisture capacity and low plasticity, there is nothing to suggest that the WUA is not an acceptable borrow source for cover material.

   Review of Response: The response to this comment is acceptable.

II. SPECIFIC COMMENTS

Section 1.1, Regulatory Background, page 1-2

1. Original EPA Comment: The last sentence in this section should be revised to include the date on which EPA approved the DGWP. In addition, the October 2013 version of the DGWP should be listed in the references section.

   FMC Response: The Data Gap Report has been revised to address this comment.

   Review of Response: The response to this comment is acceptable.

Section 1.4, Document Organization, page 1-2

2. Original EPA Comment: The first sentence in this section should be revised to refer to the Data Gap Report instead of the DGWP.

   FMC Response: The Data Gap Report has been revised to address this comment.

   Review of Response: The response to this comment is acceptable.

Table 2-1, Summary of Western Undeveloped Area (WUA) Soil Investigation, pages 2-1 and 2-2

3. Original EPA Comment: The DGWP called for collection of grab samples of silt at one foot intervals to a depth of 10 feet below ground surface (bgs) in each test pit. However, in several of the test pits, gravel was encountered at depths shallower than 10 feet bgs. Accordingly, the sampling depths indicated in Table 2-1 should be revised to indicate the actual extent of grab sampling conducted (i.e., 4 feet bgs in test pit TP003, 7 feet bgs in test pit TP009, and 6 feet bgs in test pit TP010).

   FMC Response: Table 3.1 of the Data Gap Work Plan (MWH, 2013) states that disturbed samples will be collected to a total depth of "10 feet or until gravels are contacted". Due to the size of the excavator used at the site, the test pits were able to be excavated to deeper depths up to 20.5 feet. Although samples were not generally collected at depths below 10 feet, the test pits were excavated deeper to provide visual observations and logging at deeper depths. Based on visual evidence of the test pit, it is clear that the soil characteristics of silt are uniform throughout the soil profile until the underlying gravels are contacted. Table 2-1 has been revised to add an additional column titled, "Maximum Depth of Grab Sample."

   Review of Response: The response to this comment is acceptable.

4. Original EPA Comment: Expand the footnote to this table to indicate that the qualifier NC applies to test pits in which gravels were not contacted before the maximum depth of the excavator was reached.

   FMC Response: The footnote has been revised to address the comment.

   Review of Response: The response to this comment is acceptable.

Section 2.1.1, Test Pits, page 2-2

5. Original EPA Comment: This section should be expanded to discuss the observed variability in depth to gravel within the WUA. Gravel was not encountered at all in more than half of the test pits (TP002, TP004, TP005, TP006, TP007, and TP008). Conversely, gravel was encountered at relatively shallow depths (between 4 and 7.5 feet bgs) in three of the pits (TP003, TP009, and TP010). As noted in the test pit logs (page 56 of the electronic file), this area of shallow gravel appears to cut from east to west across the center of the WUA study area. Such detail is important because it will affect the available volume of borrow soil in this location.

   FMC Response: Comment noted. Figure 4-1, showing the cut isocontour map takes into consideration this east-west trending gravel lense; and therefore, does not factor this portion of the WUA into the volume calculations for available cover soil. Section 2.1.1 has been revised to further explain the presence and extent of the gravels. (See also FMC Response to Comment 17 below.)

Review of Response: The response to this comment is partially acceptable. Figure 4-1 has been modified to more clearly show the location of the east-west trending shallow gravel lens within the WUA. This additional detail helps guide calculation of available soil volume with acceptable soil characteristics. However, as discussed below with regard to Comment 17, the report still does not present specific detail on how the estimated volume of available soil was calculated. To confirm the validity of the estimate and ensure that gravel materials have not been included, the report should be expanded to include mathematical calculations for the soil volume estimate or computer modeling results, if a software program was used to generate the estimate. In that case, the software program should also be identified in the report.

FMC Supplemental Response: Figure 4-1 was generated with the output from AutoCAD Civil 3D Version 2013. For clarity, Section 4.5 will be revised to add text after the second sentence as follows:

> "Figure 4-1 was generated with output from AutoCAD Civil 3D Version 2013 (Civil 3D) and is the output of the three-dimensional (3D) model of the site. The total volume of available soil was calculated by comparing the existing 3D topographic surface of the WUA with a cut surface representing the bottom of a hypothetical borrow excavation (cut surface). The depth of the cut surface was based on the depth of silt above the gravel lense where encountered and the maximum explored depth of silt where no gravel was encountered in the test pits and soil borings."

6. Original EPA Comment: For consistency with Table 2-1, correct this section to note that test pits were excavated to depths ranging from 4 to 20.5 feet below ground surface (bgs).

   FMC Response: Section 2.1.1 has been revised accordingly.

   Review of Response: The response to this comment is acceptable.

Section 2.1.2, Soil Borings, page 2-3

7. Original EPA Comment: As indicated in the DGWP, undisturbed silt samples were to be collected from five soil borings at depths between 2-3 and 6-8 feet below ground surface (bgs). However, Table 2-1 indicates that the only soil sample from boring SB003 was collected from 0-2 feet bgs. A review of the associated boring log in Appendix C shows that silt was encountered only in the uppermost two feet of this boring. Consequently, no undisturbed soil samples could be collected from the pre-determined depths of 2-3 and 6-8 feet bgs. While this deviation from the DGWP appears to be acceptable, an explanation for it should be provided in the text of the Data Gap Report.

   FMC Response: Section 2.1.2 has been revised to indicate that an undisturbed sample of silt was collected from 0 to 2 feet bgs in SB003 due to the presence of gravels below 2 feet at that boring location. In addition, a disturbed sample of gravel was collected from the drilling augers from 2 to 15 feet SB003. This sample was analyzed for hydraulic conductivity for the purposes of designing the potential infiltration basin as part of

Groundwater Option B. Table 2-1 has been revised to include this sample, text has been added to Section 2.1.2 to describe the collection of this sample and the hydraulic conductivity result has been added to Table 3.2.

Review of Response: The response to this comment is acceptable.

8. Original EPA Comment: As shown in Table 2-1, a silt samples from the 12-14 feet bgs interval was collected from boring SB007. The text indicates that this sample was collected to provide geotechnical information on deeper silts at the WUA. It is unclear whether a single sample will adequately represent properties of deeper silt across the WUA. Given the fact that deep silt was found in numerous test pits and borings across the WUA, it is likely that deep silt will be incorporated into the planned ET and gamma caps. Section 4 of the report should compare shallow and deep silt results (as shown on Table 3-1), and clarify whether any significant differences were evident that may impact design or construction of the ET and gamma caps. If significant differences are identified, additional samples should be collected to determine the usability of deeper silt.

   FMC Response: As described in Section 4 of the Data Gap Report, ProUCL statistical analysis was performed on laboratory data from both in-situ and ex-situ samples for maximum dry density and moisture content. Based on the analysis, the data distributions are normal suggesting a uniform soil type. In addition, a review of all particle size distribution (PSD) plots and Atterberg Limits Tests for disturbed samples of the silt further confirms a uniform soil type. It should be noted that index properties such as PSDs and Atterburg Limits are a key indicator of soil type. Additionally, the manner in which these silts were deposited, aeolian, further suggests that the physical properties of the soil with depth will remain consistent. Therefore, further sampling of silts at deeper depths is not warranted. Additional text has been added to Section 4.1 that describes the uniformity of the silt with depth.

   Review of Response: The response to this comment is not acceptable. A review of the Appendix H indicates that results for the deep silt interval (12-14 feet) at boring SB007 were not included in the statistical analyses for in-situ density, moisture, or saturated hydraulic conductivity. The available data sets for these parameters (as shown in Tables 3.1 and 3.2) do not match up with the data summaries in Appendix H in terms of maximum values, minimum values, and number of observations. Consequently, conclusions about soil uniformity based on those data distributions can only be applied to shallow silts. The analyses do not currently indicate that the shallow and deep silts are uniform, nor do they rule out the possibility that additional deep silt sampling may be needed to determine its usability for capping purposes. Moreover, although the FMC response indicates that particle size distribution and Atterberg Limits are the key indicators of soil type, the deep silt sample from boring SB007 was not analyzed for these parameters, nor were Atterberg Limits evaluated using ProUCL. The deeper silts should be further evaluated in the report, including any deep silts identified within the test pits, to determine its usability for inclusion in the gamma and ET caps.

FMC Supplemental Response:

The following text clarifying the difference between disturbed (test pit) samples and testing and in-situ (soil boring) samples and testing will be added below Table 4.1:

> "The soil boring (SB) samples from SB003, SB004, SB006, SB007 and SB008 were only tested for in-situ density and in-situ moisture content and therefore there were no SB sample results used for calculation of the maximum dry density (MDD) and optimum moisture content (OMC) means shown on Table 4.1 (or in the ProUCL output for MDD and OMC in Appendix H). Conversely, the remolded test pit soil samples were not tested for in-situ density or moisture or in the calculation of in-situ density and in-situ moisture means shown on Table 4.1 (or in the ProUCL output in-situ density and in-situ moisture in Appendix H)."

The hydraulic conductivity results for the samples from SB007 were not included in the average hydraulic conductivity value specified in Table 4.3 because these were in-situ samples and not remolded samples (i.e., test pit samples were remolded for laboratory tests). The values specified in Table 4.2 are from the remolded (test pit) samples and represents the WUA borrow soil "after" excavation, haul, placement and compaction (i.e., remolded) to the design density for the gamma and ET caps. New text will be added below Table 4.2 in Section 4.2 as follows:

> "The values specified in Table 4.2 are from the remolded (test pit) samples only and represents the WUA borrow soil "after" excavation, haul, placement and compaction (i.e., remolded) during placement of the caps; therefore the in-situ hydraulic conductivity test results from the SB007 samples are excluded from the calculated K_{sat} mean."

As described in the Section 4.1, the test pit samples were not collected at depths deeper than 10 feet. However, the uniformity of the soil was clearly evident based on texture, plasticity, and color of the soil during visual observations of both shallow and deeper silts encountered in the test pits and borings. The results of the soil testing associated with the test pit samples were used in the development of material specifications for the cover soil that will be required to be met during the remedial action. During the capping phase of the remedial action, borrow source material testing will be required during construction at a specified frequency specified in the Construction Quality Assurance / Quality Control Plans (CQAP / CQCP). Any areas of soil, whether within the upper 10 feet or deeper, that are outside those specifications will either not be used or amended to meet the material specifications. Per Section 4.5, approximately 2.4 million CY of soil (silt) is available for borrow compared to the preliminary required soil volume based on a 12-inch gamma cap and 30-inch ET cover of approximately 1.3 million CY which provides additional flexibility to selectively excavate borrow material that meets material specifications. Therefore, additional material testing of deeper soils is not necessary at this time.

9. Original EPA Comment: According to the Table 3.1 of the DGWP, gravel samples were to be collected from the five soil borings at a depth approximately 10 feet beneath the gravel horizon. However, it does not appear that gravel samples were collected from the soil borings for permeability analysis. In fact, Section 2.1.2 of the report indicates that the only one gravel sample collected during this investigation was taken from test pit TP003, and the associated log in Appendix B (page 46 of the electronic file) suggests that the samples was collected from the top of the gravel horizon (i.e., at 4feet bgs, rather than 14 feet bgs). This deviation from the approved DGWP suggests that inadequate gravel data has been obtained. The text of the report should be revised to: (1) document these deviations in the sampling program; (2) discuss whether the single, shallow gravel sample is representative of gravel across the WUA; and (3) explain why additional gravel samples are not needed to meet RD information needs. If sufficient justification cannot be provided, additional gravel samples are recommended.

   FMC Response: While preparing the Data Gap Work Plan, the depths of gravels were believed to be much shallower, on the order of ±10 feet. However, during the test pitting, the depths of gravel were shown to be generally much deeper than 10 feet throughout the site, with the exception of the shallow east-west gravel lense. The main purpose of the gravel sampling was to determine the hydraulic conductivity of the gravels for the purpose of sizing potential infiltration basins for treated groundwater for groundwater remedy water management option B. Given that the depth of excavation required to obtain the volume of capping soil will in general be much shallower than the underlying gravels, it was determined that the controlling factor in the infiltration basins will be the in-situ hydraulic conductivity of the silts. Therefore, an undisturbed sample of the silts at deeper depth, 12-14 feet bgs, was collected from SB0007 to provide data for this purpose. Further, the gravels that were contacted appeared to be very uniform in terms of shape and size suggesting the hydraulic conductivity of these gravels will be fairly uniform. Therefore, no additional sampling is required at deeper depths for the gravels. Additional text has been added to Section 2.1.2 that incorporates this response.

   Review of Response: The response to this comment is acceptable. However, given the concerns over the representative nature of existing deep silt data (as discussed in the previous comment), additional detail should be provided as to whether the single deep silt sample provides enough information on in-situ hydraulic conductivity to for decision-making with regard to the infiltration basins.

   FMC Supplemental Response: The following additional text has been added as a new last paragraph in Section 4.2:

   > The in-situ hydraulic conductivity test results from the SB007 sample from 12 to 14 ft bgs will be used for the preliminary design of the groundwater remedy water management option B infiltration basin(s). Due to the prevalence of silt to greater depths than initially expected, the preliminary design of the basin(s) will be based on the in-situ hydraulic conductivity of the silt samples from SB007. The average of those results is 1.86E-04. Additional sampling and testing of deeper silt in the WUA

may be recommended to advance the groundwater remedial action design from the preliminary to final design.

10. Original EPA Comment: The first sentence in this section should be corrected to note that the five soil borings advanced during this investigation were numbered SB003 through SB008, with the exception of SB005. No soil boring was conducted in the vicinity of test pit TP005.

    FMC Response: The text has been revised to address the comment.

    Review of Response: The response to this comment is acceptable.

Section 2.2.1, Stormwater Sewer Survey Background and Objectives, page 2-3

11. Original EPA Comment: The first paragraph in this section indicates that the selected remedy for RA-A calls for covering the area (and underground storm sewer piping) with a gamma cap. The second paragraph indicates that any segments of the storm sewer pipe that cannot be cleaned within RA-B will be plugged with concrete and covered by an ET cap. Expand this section to identify remedial action objectives (RAOs) for the storm sewer, and confirm that both types of caps will satisfactorily achieve those RAOs.

    FMC Response: The relevant RAOs for the underground storm sewer piping in RA-A (and RA-B and RA-K) as taken from Table 4-2 of the Supplemental Feasibility Study Report for the FMC Plant OU – July 2010 (SFS Report) are:

    1. Prevent external exposure to radionuclides in soils at levels that pose estimated excess risk greater than 1 x 10-4, or site-specific background levels where that is not practical.
    2. Prevent ingestion of soils containing COCs at levels that pose estimated excess risks above 1 x 10-4, a non-cancer risk HQ of 1, or site-specific background levels where that is not practical.
    3. Reduce the release and migration of COCs to the groundwater from facility sources that may result in concentrations in groundwater exceeding risk-based concentration (RBCs) or chemical specific Applicable or Relevant and Appropriate Requirements (ARARs), specifically Maximum Contaminant Levels (MCLs).

    In addition, the following RAO was developed (as presented in Section 7.1.1 of the SFS Report) to address elemental phosphorus (P4) in subsurface soils and underground piping as a principal threat source material (PTSM):

    - Prevent direct exposure to P4 under conditions that may spontaneously combust, posing a fire hazard, or resultant air emissions that represent a significant risk to human health and the environment.

    Underground storm sewer piping that is successfully cleaned in-place will no longer present a threat to human health and/or the environment as all COCs potentially

associated with the storm sewer piping (i.e., P4, radionuclides, metals, and leachable metals posing a threat to groundwater) will have been removed and appropriately disposed. Therefore, cleaned underground storm sewer piping by itself meets all of the above-listed RAOs. While this underground storm sewer piping resides in RA-A, which will be capped with a gamma cap as prescribed in the IRODA, the remedial action for the underground storm sewer piping is independent of the requirement for placement of the gamma cap in RA-A.

While we generally understand that the underground storm sewer piping can be cleaned with readily available technology, a contingency was included in Section 2.2.1 of the Data Gap Report, in the event sections of the piping could not be cleaned. In that event, the ET cap placed over RA-B could be extended over the un-cleaned sections of underground piping. As stated in the SFS Report and accepted in the IRODA, placement of a properly designed ET cap over underground piping would meet all of the above listed RAOs, even with the presumption that radionuclides, metals, and/or P4 remain within the un-cleaned sections of the underground storm sewer piping.

Regardless, at any level of success of cleaning of the underground storm sewer piping in RA-A, the underground piping would be plugged at the boundaries of RA-A with RA-B and RA-K to eliminate a conduit for water moving between the different capped areas.

Section 2.2.1 has been modified to clarify this achievement of the RAOs.

Review of Response: The response to this comment is acceptable.

Section 2.2.2, Video Survey Description, pages 2-4 and 2-5

12. Original EPA Comment: This section summarizes results of the storm sewer video survey which, as shown on Figure 2-2, extended across RA-A, RA-B, and RA-K. Each segment in the figure appears to have been addressed except for the one between Area Inlets 1 and 3. Confirm the status of surveying over this area and modify the Data Gap Report accordingly.

    FMC Response: The Data Gap report has been revised to better clarify that while historical plant drawings indicate that the piping segment from Area Inlet #1 to Area Inlet #3 exists, visual investigation of the vault at Area Inlet #1 did not reveal the presence of a pipe entering from the south – only a pipe running towards the north to the East Discharge. Similarly, visual investigation of the vault at Area Inlet #3 only revealed pipes connected on the south side (from Manhole #1) and west side (toward Area Inlet #4); no pipe leaving to the north towards Area Inlet #1 was present. Whether the historical drawing was incorrect or had not been updated to reflect later removal of the pipe segment cannot be determined; regardless, there is no observable evidence that a segment of piping is present between Area Inlet #3 and Area Inlet #1. Therefore, this segment was not present to survey. The figure has been revised to indicate this piping segment is not present and a bullet has been added at the end of Section 2.2.2 that incorporates this response into the text.

Review of Response: The response to this comment is acceptable.

Section 3.1.2, Hydrological Testing, page 3-1

13. Original EPA Comment: According to Table 3.2 of the DGWP, disturbed soil samples from every other test pit were to be sampled for saturated hydraulic conductivity (ASTM D5084) at 85 and 90% of the maximum dry density (MDD) level. Thus, ten samples would undergo conductivity testing. Ten water characteristic curve tests (ASTM D6836) – two tests on every other test pit sample – were also slated for completion. However, Table 3-2 of the report suggests that only five test pit samples were subjected to these analyses. A review of Appendix D indicates that all five of the test pit samples were analyzed at 85% MDD, and that no data are available for conductivity at 90% MDD. These deviations from the work plan should be noted in the text, along with an explanation as to why these changes should not be considered lingering data gaps for the investigation.

    FMC Response: The DGWP specified that Soil Water Characteristic Curve Testing would be performed on disturbed samples remolded to both 85 and 90% of MDD. However, Water Characteristic Curve Testing was performed only on disturbed samples remolded to 85% MDD. The deviation was mainly due to the fact that the construction specifications for the cover soil (silt from the WUA) would target an in-place density of 85% MDD ±3%. This specification has been chosen to limit the in-place density to below 90% MDD. Therefore, Water Characteristic Curve Testing at 90% MDD was not warranted. Section 3.1.2 has been revised to describe and justify this deviation from the Work Plan.

    Review of Response: The response to this comment is not acceptable. As stated in the report and response, the target in-place density of soil in the cap is 85% of the MDD ±3%. Water characteristic curve testing was performed on all five test pit soil samples after remolding to 85% of the MDD. However, it is noted that the in-place soil density may acceptably range between 82 and 88% of the MDD. Analyzing the soil samples after remodeling to 90% of the MDD would have provided information on potential moisture storage in an ET cap under worst-case in-place density conditions. By deviating from the approved DGWP, there is no data with which to ascertain potential water storage capabilities if the cap is compressed to the high end of the acceptable in-place density range (i.e., 88% of the MDD). This uncertainty should be discussed in the report, along with actions needed to close the lingering data gap.

    FMC Supplemental Response: The range of ±3% of maximum dry density was developed in order to provide some flexibility during construction while at the same time not impacting the performance of the soil cover. As shown in Table 4.1, the average MDD value for the disturbed samples was 104.2 pcf with a specified range between 85.5 and 91.7 pcf, corresponding to 82% and 88% of MDD, respectively. As indicated from the SWCC laboratory testing reports (Appendix D), those samples were compacted to densities ranging between 84.7 and 90.9 pcf, which is generally within the bounds of the

specified range. Note that as the Data Gap Work Plan was prepared far in advance of the Preliminary (30%) RD for the soil remedy, the compaction specification had not yet been deleloped. Given the designed compaction specification (85% MDD ± 3%), testing at 90% was no longer warranted.

In addition, although higher degrees of compaction have been documented to reduce moisture storage capacity and root zone development, the proposed compaction range specified will not significantly impact these material properties. As specified in the Natural Resource and Conservation Society (NRCS) soil quality indicators reference (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053256.pdf), recommends the following range of densities for silty soils:

- Ideal bulk density for plant growth - <87.4 pcf
- Bulk density that restrict plant growth - >103 pcf

Therefore, the values specified are within the values for maintaining plant growth. During construction quality control and assurance will be performed to document the placement and compaction of the ET cover meets the design and specifications. The paragraph below Table 3.2 will be revised to incorporate the relevant portions of this response as follows:

> "The DGWP specified that Soil Water Characteristic Curve (SWCC) testing would be performed on disturbed samples remolded to both 85 and 90% of MDD. However, SWCC testing was performed only on disturbed samples remolded to 85% MDD. The deviation was mainly due to the fact that the construction specifications for the cover soil (silt from the WUA) would target an in-place density of 85% MDD ±3%. The average MDD value for the disturbed samples was 104.2 pcf (Table 4.1) with a specified range between 85.5 and 91.7 pcf, corresponding to 82% and 88% of MDD (85% ± 3%), respectively. As indicated from the SWCC laboratory testing reports (Appendix D), those samples were compacted to densities ranging between 84.7 and 90.9 pcf, which is generally within the bounds of the specified range. Although higher degrees of compaction have been documented to reduce moisture storage capacity and root zone development, the proposed compaction range specified will not significantly impact these material properties. Therefore, Water Characteristic Curve Testing at 90% MDD was not warranted."

Section 3.2, Root Density Testing, pages 3-4 through 3-6

14. Original EPA Comment: Appendix F shows that root density testing was performed on depth-specific samples collected from three locations in each of nine grids across the existing vegetable trial plot. Expand Table 3.4 of the report to also show root density results for Grid 16, Location 3; all three locations within Grid 17, and all three locations within Grid 18 (provided on page 178 of the electronic file). In addition, correct the last sentence on page 3-6 to refer to the 6- to 12-inch interval at Grid 8, which was not analyzed because it was compromised during shipping. Finally, describe the incident in which this sample was compromised and detail steps taken to ensure that none of the other samples had been similarly affected.

FMC Response: Table 3.4 has been revised to list the additional samples from Grids 16, 17, and 18. The last paragraph of Section 3.2 has been revised to correct the reference to Grid 8 and explain that the sample bag was reported as torn when received at the laboratory and was evidently damaged during shipment.

Review of Response: The response to this comment is acceptable.

Section 4.1, Geotechnical Recommendations, page 4-1

15. Original EPA Comment: This section should be expanded to discuss results pertaining to the susceptibility of WUA soils to erosion and desiccation cracking, as determined during the data gap investigation. The discussion should also indicate whether the majority of WUA soils are sufficiently nondispersive for purposes of cap construction. Any limitations on use of WUA borrow soil identified as dispersive (i.e., rating a 3 via the Crumb Test) should also be specified.

    FMC Response: Additional text related to the erosion and desiccation potential of the WUA soils has been added to Section 4.1. Atterberg limits and dispersive testing was performed on the majority of disturbed samples to assess the potential for desiccation cracking and erosion of the silts. Based on the Atterberg limits testing, the plasticity index (PI), ranged between 1 and 14. These results indicate that the soils have very low plasticity and therefore are not susceptible to desiccation cracking associated with volumetric changes (shrinkage) induced by moisture fluctuations. The results of the dispersion testing both (Crumb and double hydrometer testing) indicate that the soils are generally non-dispersive to moderately dispersive based on Crumb test results characterizing the majority of samples being between a Grade 1(non-dispersive) and 2 (Intermediate) and double hydrometer testing ranging between 18.6 and 44.3-percent dispersion. Therefore, based on these results, there is nothing to preclude the WUA soils being used as capping soil.

    Review of Response: The response to this comment is acceptable.

Section 4.3, Root Density Recommendations, page 4-2

16. Original EPA Comment: Statistical analyses presented in Appendix H indicated depth-specific root density mean values (expressed as grams of dry root material per 100 grams of soil) of:

    - 0.067 grams in the 0-6 inch sampling interval;
    - 0.0337 grams in the 6-12 inch sampling interval; and
    - 0.014 grams in the 12-18 inch sampling interval.

    A statistical evaluation of all 53 soil samples collected from the 0-6 and 6-12 inch intervals yielded a mean root density value of 0.051 grams. As noted in Section 4.3, this value was selected as the design root density value to be used in RD development.

However, it is unclear why results from the 12-18 inch sampling interval were not included in this analysis. If root density below the uppermost foot of soil is not considered an important factor for cap design, it is unclear why soil samples were even collected from the deeper intervals for root density analysis. Expand the text to provide justification for these omissions and to explain how use of the selected design value will affect establishment of an adequate vegetative cover layer on the ET and gamma caps.

FMC Response: Samples collected below 6-12 inches were not factored into the statistical analysis because the cover design assumes the bulk of root density is within the upper 12-inches. This is a conservative assumption given that there were roots present below 12-inches. However, due to the sparser aerial distribution of the 12-18-inch soil thickness at the re-vegetation test area, these data were not included in the statistical analysis. No changes to the text are warranted.

Review of Response: The response to this comment is acceptable.

Section 4.5, Borrow Source Availability, page 4-2

17. Original EPA Comment: This section states that approximately 2.4 million cubic yards of silt are available at the WUA for use in the ET and gamma covers. However, this estimate is unsupported by mathematical calculations or software output. Instead, this estimate was reportedly based on Figure 4-1, an isocontour map showing the depth of silt in the WUA. However, this figure is confusing, with contour lines that are unlabeled and difficult to translate into depths. It is possible that a different visual approach (e.g., using shades of color to represent silt thickness) would facilitate interpretation of Figure 4-1. Moreover, it does not appear that the figure accounted for soils deemed unusable due to dispersivity or other considerations. Revise the figure to provide for better interpretation, and provide calculations demonstrating how the figure was determined.

    FMC Response: Figure 4-1 has been revised to change it from an isocontour to an isopach drawing to show color shading associated with depths of excavation. Note that the borrow availability assessment excludes from consideration the area in the vicinity of the shallow gravels. Additionally, there is no evidence to preclude any silt soils from being used as borrow material based on dispersion or desiccation potential. No changes to the text are warranted.

    Review of Response: The response to this comment is partially acceptable. Figure 4-1 has been modified to more clearly show the location of the east-west trending shallow gravel lens within the WUA. This additional detail helps guide calculation of available soil volume with acceptable soil characteristics. However, as discussed above with regard to Comment 5, the report still does not present specific detail on how the estimated volume of available soil was calculated. To confirm the validity of the estimate and ensure that gravel materials have not been included, the report should be expanded to include mathematical calculations for the soil volume estimate or computer modeling results, if a software program was used to generate the estimate. In that case, the software program should also be identified in the report.

FMC Supplemental Response: As described in FMC's Supplemental Response to Specific Comment 5, Figure 4-1 was generated with the output from AutoCAD Civil 3D Version 2013. AutoCAD Civil 3D was primarily developed and marketed to support the design of large earthwork projects like the soil remedy for the FMC OU. Section 4.5 will be revised per FMC's Supplemental Response to Specific Comment 5.

Table 4.3, Summary of Stormwater Sewer Piping Video Survey, page 4-3

18. Original EPA Comment: After adding in sediment and other solids present between Area Inlets 1 and 3 (as discussed in Specific Comment 12 above), this table should be identified as a conservative estimate of solids to be removed from the storm sewer in areas RA-A, RA-B, and RA-K. Relatively clear areas noted in Section 2.2.2 of the report (i.e., the first 40 feet in the segment from the east discharge pipe toward Area Inlet 1 and the first 55 feet in the segment from Manhole 1 to Area Inlet 3) do not appear to have been subtracted out of the volume calculations in this table.

    FMC Response: As stated in response to Comment 12 above, the piping segment between Area Inlets 1 and 3 has been determined to no longer be present based on visual investigations in the vaults at both Area Inlet 1 and Area Inlet 3. Therefore, this segment was not included in Table 4.3. Also, column 6 (*Percent full of Sediment*) is an estimated average over the total length of the piping segment. A footnote has been added to Table 4.3 to indicate that the calculated "maximum" sediment volumes are a conservative estimate for waste management planning purposes.

    Review of Response: The response to this comment is acceptable.

Comments that were inadvertently left out of the original comment set:

Acronyms/Abbreviations, page iv

19. EPA Comment: Add POTW

    FMC Response: POTW will be added to the acronym list.

Section 1.1, paragraph 2, line 5, page 1-2

20. EPA Comment: Include a date

    FMC Response: The missing date was inserted in the March 2014 "highlighted" revision of the Data Gap Report.

Section 2.3, paragraph 1, line 5, page 2-5

21. EPA Comment: states '…transect was further divided into 5 ft by ft sampling grids', please include a 5 between 'by' and 'ft'.

FMC Response: Text will be revised per the comment.

Section 3.2 paragraph 1, lines 3 and 4, page 3-6

22. EPA Comment: please clarify if all three 6 to 12 inch samples from Grid #18 were compromised during shipping or specify from which location(s) the sample(s) was compromised.

FMC Response: None of the samples from Grid #18 were compromised during shipping. The Grid #8 Location #1 for the 6 to 12 inch interval was the only sample compromised during shipping. For clarification, the text will be revised to insert "Location #1" after "Grid #8" in the third sentence following Table 3.4.

Table 3.4, page 3-6

23. EPA Comment: please include data from Grid #18.

FMC Response: Data from Grid #18 was included in Table 3.4 in the March 2014 "highlighted" revision of the Data Gap Report.

Section 4.2, page 4-1, and Table 4.2, page 4-2

24. EPA Comment: please include a descriptive and specific explanation of how the mean hydraulic conductivity estimate and other values were derived. Based on the data presented in Table 3.2, the mean hydraulic conductivity is 1.007E-4 cm/sec or 6.65E-5 cm/sec if data from SB7 is omitted; it is not clear how the 6.57E-5 cm/sec presented in Table 4.2 was derived.

FMC Response: The hydraulic conductivity results for the samples from SB007 were not factored into the average hydraulic conductivity value specified in Table 4.3 because these were in-situ samples and not remolded samples (i.e., test pit samples were remolded for laboratory tests). The values specified in Table 4.2 are from the remolded (test pit) samples and represents the WUA borrow soil "after" excavation, haul, placement and compaction (i.e., remolded) to the design density for the gamma and ET caps. New text will be added below Table 4.2 in Section 4.2 as follows:

> "The values specified in Table 4.2 are from the remolded (test pit) samples only and represents the WUA borrow soil "after" excavation, haul, placement and compaction (i.e., remolded) during placement of the caps; therefore the in-situ hydraulic conductivity test results from the SB007 samples are excluded from the calculated K_{sat} mean."

Section 4.3, page 4-2

25. EPA Comment: please specify over what depth(s) the mean root density value of 0.051 grams of root per 100 grams of soil was derived. If multiple depth intervals (i.e. 0-6 inches and 6-12 inches) were pooled to arrive at the 0.051 value, were statistical analysis conducted to confirm pooled intervals are from the same population? Please clarify in report, be descriptive and specific.

FMC Response: An average of 0 to 6 inch and 6 to 12 inch intervals was calculated largely because the 12 to 18 inch and 18 to 24 inch intervals had significantly lower root densities. However, as the root density results from all four intervals will be used in the ET soil cover modeling. Section 4.3 will be revised to present average root densities for each of the four intervals as follows:

"The main purpose of the root density testing was to quantify the vegetation quality that can be established for used in the ET soil cover modeling. The mean was calculated for each interval as shown on Table 4.3. The ProUCL output is provided in Appendix H."

Table 4.3 Mean Root Densities for Sampled Intervals

Soil Interval	Grams of Roots per 100 grams of Soil (mean)
0-6 inches	0.067
6-12 inches	0.034
12-18 inches	0.014
18-24 inches	0.00

The newly inserted table will added to the Table of Contents, previously numbered Table 4.3 will be renumbered to Table 4.4, and the ProUCL output for all four soil intervals will be inserted (to replace the root density output) in Appendix H.

<END>